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(71) Applicant(s)

(56) Documents Cited  
EP 0967128 A2  
EP 0914992 A1EP 0926018 A1  
US 4249632 AAutoliv Development AB  
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Sweden

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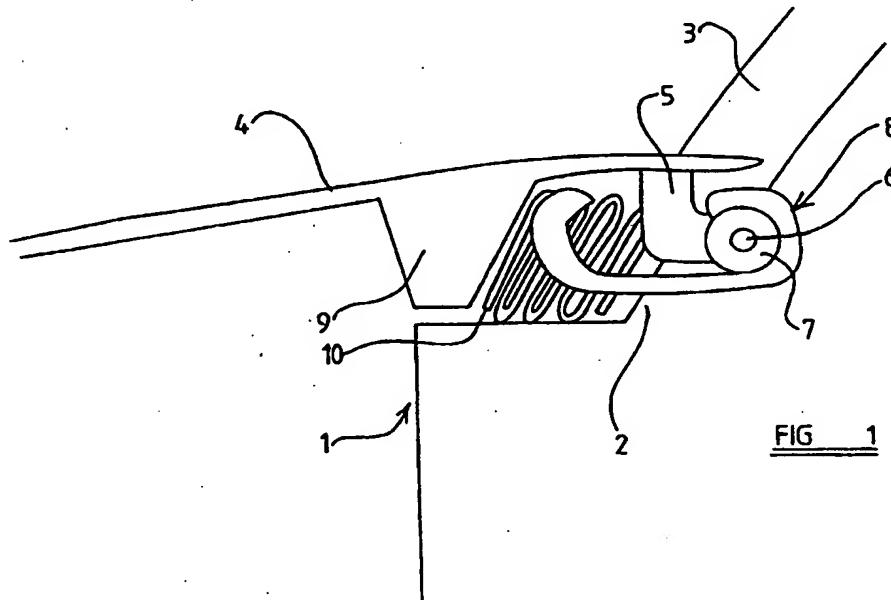
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(54) Abstract Title

An air-bag arrangement for deployment between the rear of the bonnet and the windscreen of an automobile

(57) An air-bag arrangement is provided in an automobile. The rear part of a bonnet (4) in an automobile has an L-shaped arm (5) carrying a hinge-pin (6) provided with a bush (7), the bush being retained within a bracket (8). An air-bag (10) is located beneath the rear part of the bonnet (4). On inflation of the air-bag (10) the bush (7) is disconnected from the bracket (8) permitting the rear part of the bonnet (4) to be moved upwardly by the inflating air-bag (10).



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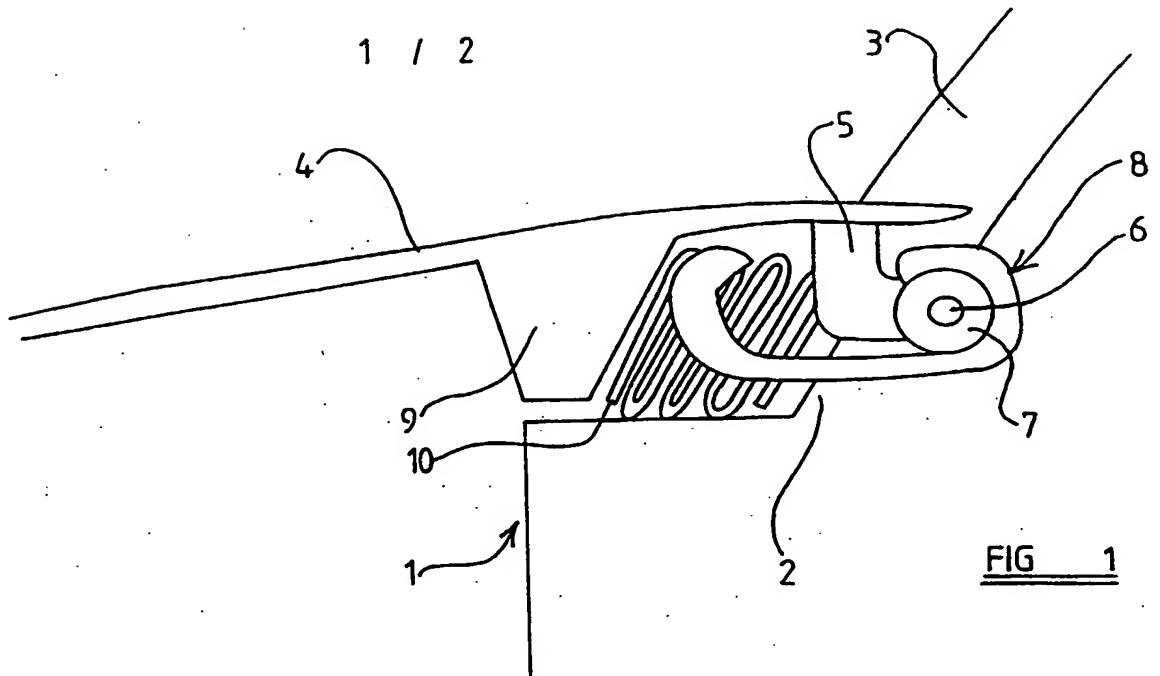


FIG 1

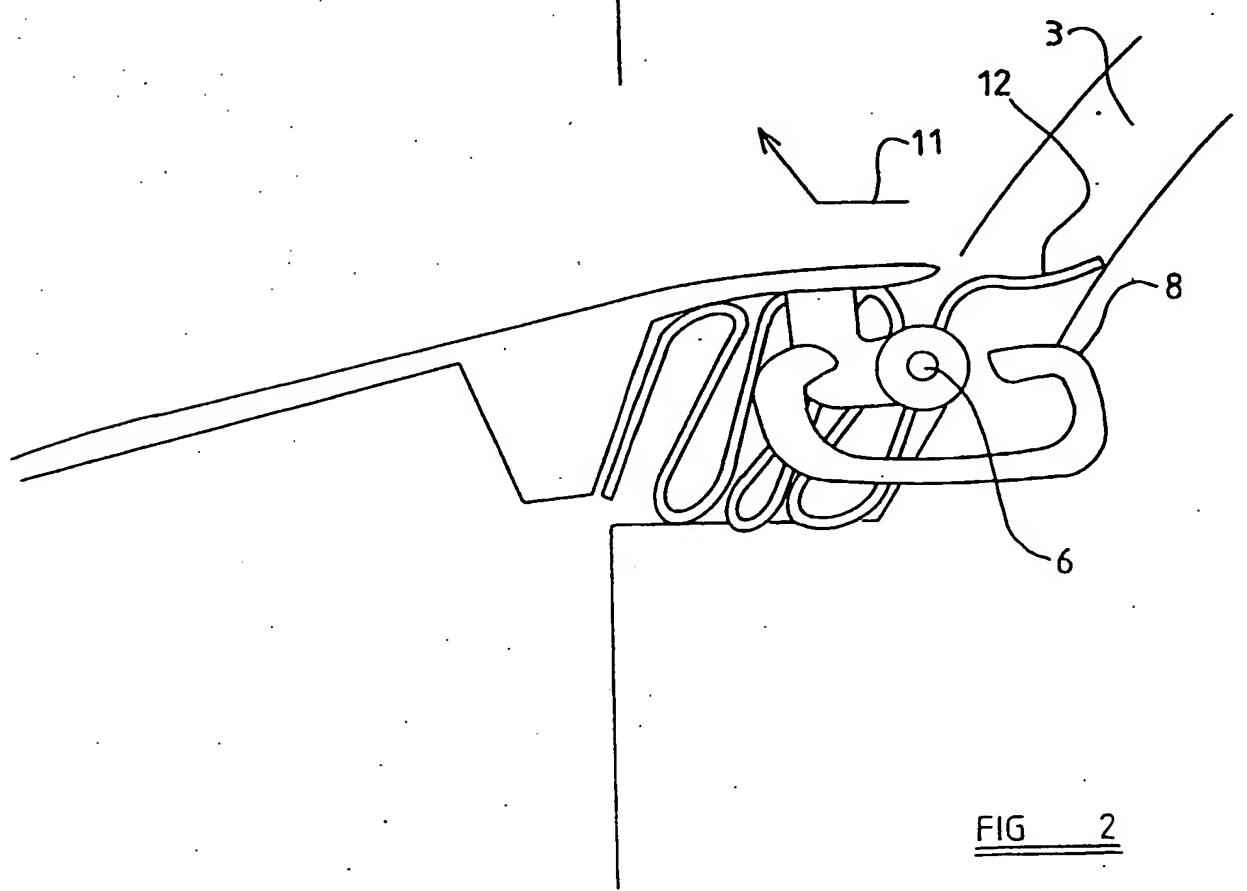


FIG 2

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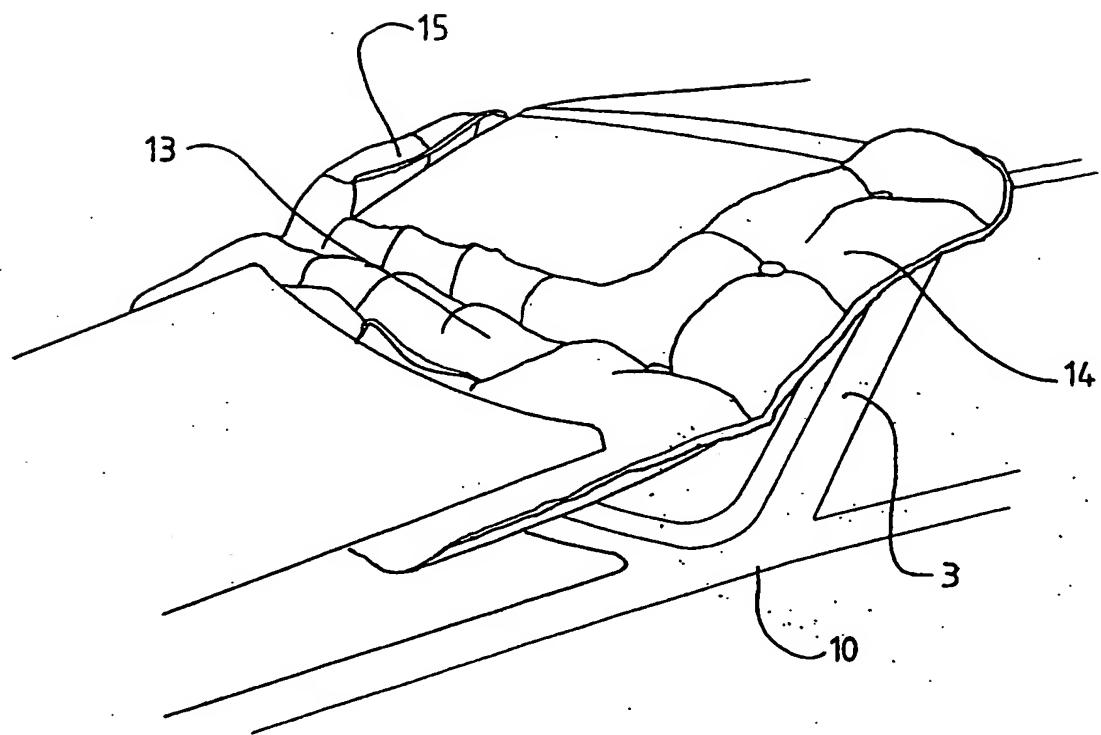


FIG 3

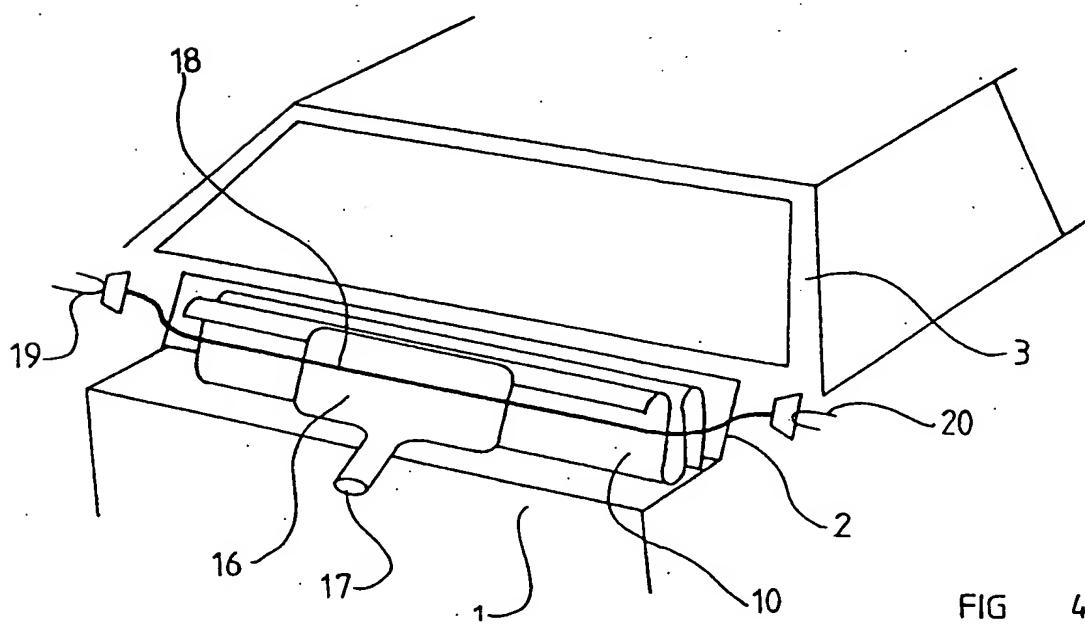


FIG 4

2368562

PATENTS ACT 1977

P14383GB-NF/jsd

DESCRIPTION OF INVENTION

**"IMPROVEMENTS IN OR RELATING TO AN AIR-BAG ARRANGEMENT"**

**THE PRESENT INVENTION** relates to an air-bag arrangement, and more particularly relates to an air-bag arrangement to be mounted on a motor vehicle to provide protection for a pedestrian impacting with the vehicle in an accident situation.

If a pedestrian impacts with a vehicle in an accident situation, the pedestrian can be severely injured. It has been found, however, that if an air-bag is utilised to lift the bonnet of the vehicle, the risk of injury to a pedestrian may be reduced since the bonnet may then move downwardly, in an energy-absorbing manner, if impacted by the pedestrian. It has also been proposed to provide an air-bag arrangement which not only lifts the bonnet, in the manner described above, but also provides some protection which extends at least partly up the "A"-Posts of the vehicle. An arrangement of this type is disclosed in EP-A- 0967128.

The present invention seeks to provide an improved air-bag arrangement.

According to this invention there is provided an air-bag arrangement in a motor vehicle, having a bonnet, the rear part of the bonnet having retaining means which engage co-operating components on the main part of the vehicle to retain the rear part of the bonnet in a predetermined position, the air-bag arrangement comprising an inflatable air-bag located adjacent a fixed part of the body of the vehicle and beneath the rear part of the bonnet of the vehicle, means being provided which, in response to inflation of the air-bag, release the retaining means so that, on inflation of the air-bag, part of the inflated air-bag will be located beneath and support the rear part of the bonnet.

Preferably the retaining means comprise hinge pins provided at the rear of the bonnet, each hinge pin being received within a bush, the bush being received within a recess in a support bracket mounted on the main part of the vehicle, the recess having an opening having a width slightly less than the diameter of the bush, the bush or the bracket being deformable so that, on inflation of the air-bag, the bush may pass through the opening to move out of the recess.

Conveniently the bush is a deformable bush. Alternatively the bracket defining the recess is of a deformable material.

Advantageously the bush is a cylindrical bush, and the recess is a substantially "C"-shaped recess.

Preferably the air-bag is initially located between a scuttle provided on the motor vehicle adjacent the lower part of the front windscreens, and a rearwardly directed face provided on the bonnet so that inflation of the air-bag will cause part of the bonnet to move forwardly to release the retaining means.

In an alternative embodiment of the invention the retaining means comprise bonnet catches provided on the bonnet, and co-operating components on the main part of the vehicle, the bonnet catches being adapted to be released in response to inflation of the air-bag.

Conveniently the bonnet catches are actuated by a wire or cable, the wire or cable passing adjacent part of the air-bag in the uninflated state so that, on inflation of the air-bag, tension will be applied to the wire or cable to release the catches.

Preferably the bonnet is a front-hinged bonnet.

Advantageously the air-bag, when inflated, has parts thereof which extend up the "A-Post provided at each side of the motor vehicle.

Conveniently the air-bag, when inflated, has part thereof which extends across the lower part of the windscreen of the vehicle.

In order that the invention may be more readily understood, and so that further features thereof may be appreciated, the invention will now be described, by way of example, with reference to the accompanying drawings in which:

FIGURE 1 is a diagrammatic sectional view showing the rear part of a bonnet and an "A"-Post of a vehicle, illustrating the connection between the rear part of the bonnet and the vehicle,

FIGURE 2 is a view corresponding to Figure 1 illustrating the situation that exists shortly after an air-bag has commenced inflation,

FIGURE 3 is a perspective view illustrating the air-bag of Figures 1 and 2 when fully inflated, and

FIGURE 4 is a diagrammatic view of part of a vehicle showing a modified embodiment of the invention.

Referring initially to Figure 1 of the accompanying drawings, a motor vehicle is provided with a fire wall 1 and a scuttle 2, provided at the rear of the engine compartment. The vehicle has an "A"-Post 3, and the vehicle also has a bonnet 4 which is pivotally connected to the vehicle in the region adjacent the scuttle and which is retained in the lowered position by a standard sprung thorn located at the front of the bonnet.

The bonnet 4 is provided with a depending cranked generally "L"-shaped hinged arm 5 which carries, at its end remote from the bonnet, a hinge pin 6. The bonnet, in ordinary use, may rotate about the hinge pin.

The hinge pin 6 is received within a bush 7 formed of plastics or other resilient material. The bush 7 is retained within the generally "C"-shaped recess defined by a supporting bracket 8, which is mounted on the main part of the vehicle. The width of the open mouth of the "C"-shaped recess is slightly less than the diameter of the bush 7. The combination of the support bracket 8 and bush 7 serves to retain the hinge pin, and thus the rear part of the bonnet, in a predetermined position.

The under-surface of the bonnet is provided with a depending stiffening rib 9, and an inflatable air-bag 10 is provided located between the stiffening rib 9 and the scuttle 2.

The air-bag 10 will be retained within a package secured to the upper part of the fire wall 1 and the scuttle 2 so that the bonnet may be opened and closed in a conventional way by releasing the standard sprung thorn provided at the front of the bonnet and pivoting the bonnet about the axis of the hinge pin 6 with the hinge pin 6 rotating within the bush 7.

A sensor is provided adapted to sense an impact or a potential impact with a pedestrian. Such a sensor may comprise an ultra-sonic sensor or a radar sensor, or may comprise a sensor in the bumper or fender of the vehicle responsive to contact with a pedestrian. The sensor is adapted to control an inflator or gas generator such that when a potential accident situation, or an actual accident situation, is detected, gas is supplied to the air-bag 10 to inflate the air-bag 10.

As shown in Figure 2, as the air-bag 10 commences inflation, a forwardly directed force is applied to a rearwardly directed face on a stiffening rib 9 provided on the under-surface of the bonnet 4. This is because the air-bag is retained between the scuttle 2 and the rearwardly directed face of the rib 9, and as it inflates an equal and opposite force is applied to both these components. The bonnet 4 tends to move forwardly, with a slight deformation of the standard sprung thorn provided at the front of the bonnet, and the plastic bush is compressed slightly to permit the bush 7 to move forwardly out of the "C"-shaped recess defined by the supporting bracket 8. As the bush 7 moves out of the "C"-shaped recess, the bush becomes free and consequently the inflating air-bag 10 will tend to force the rear part of the bonnet 4 in an upward direction. Thus the bonnet executes a slight forward motion in a direction parallel with the longitudinal axis of the vehicle followed by an upward motion of the rear part of the bonnet as indicated by the arrow 11 in Figure 2.

In an alternative embodiment the supporting bracket 8 may be formed of a yieldable material so that the C-shaped recess yields or opens to enable the bush 7 to be released.

As can be seen in Figure 2, part of the air-bag, illustrated as part 12, moves through the space provided between the rear part of the bonnet and the "A"-Post 3 of the vehicle and starts to "creep" up the "A"-Post as it becomes inflated.

Referring now to Figure 3, it can be seen that when the air-bag 10 is fully inflated, part of the air-bag 13 extends across the lower part of the windscreen, and two parts 14, 15 lie over the two "A"-Posts provided at either side of the vehicle. It can be clearly understood that the rear part of the bonnet 4 is supported by part of the air-bag 10 which is located beneath the rear part of the bonnet, and thus if a pedestrian impacts with the bonnet, the whole bonnet may move downwardly, additionally compressing part of the air-bag 10, or the central part of the bonnet in contact with the torso of the pedestrian, which is not directly supported by the air-bag, may deform without the under-surface of the bonnet impacting with the engine or any other component within the engine compartment. Thus at least that part of the bonnet that is contacted by the pedestrian will move downwardly with energy being absorbed, thus reducing the risk of the pedestrian being injured. The energy is absorbed either by the compression of the air-bag, or by deformation of the bonnet, or both.

In the embodiment described with reference to Figures 1 to 3, the bonnet is a rear-hinged bonnet. The hinge pin 6, carried by the bonnet and the associated bush constitute retaining means which engage with the bracket mounted on the main part of the vehicle to retain the rear part of the bonnet in a

predetermined position whilst permitting "ordinary" hinging of the bonnet when access is required to the engine compartment beneath the bonnet.

Figure 4 illustrates an alternative embodiment of the invention in which the bonnet (which is not actually shown in the figure) is a front-hinged bonnet.

The vehicle shown in Figure 4 is provided with a fire wall 1 and scuttle 2 of the type discussed above. Mounted on the scuttle 2, in an appropriate package, is an air-bag 10 of the type discussed above. Mounted in front of the air-bag 10 is an auxiliary air-bag element 16 provided with an associated filling tube 17. The element 16 is adapted to be inflated before the main air-bag 10 is inflated. Extending across the auxiliary chamber is a wire or cable 18 which extends, on either side of the vehicle, to a respective bonnet catch 19, 20. Each bonnet catch is mounted on the vehicle and is adapted to engage a co-operating catch element mounted on the bonnet of the vehicle. Each catch may be independently actuated from the interior of the vehicle to enable the bonnet to be released to be hinged forwardly to provide ordinary access to the engine compartment beneath the bonnet. However, each bonnet catch 19, 20 may be actuated in response to tension being applied to the wire or cable 18.

It is to be appreciated that the vehicle shown in Figure 4 will be provided with a sensor adapted to sense an impact, or potential impact, with a pedestrian as described with reference to the embodiment shown in Figures 1 to 3. Thus, when a potential accident situation, or an actual accident situation, is detected, gas is supplied to the air-bag 10 in order to inflate the air-bag 10. However, in this embodiment the gas is initially supplied through the filling tube 17 causing the primary inflation chamber 16 to inflate. This applies tension to the wire 18, thus releasing the bonnet catches 19 and 20. The bonnet

is thus free to hinge about the front hinges which mount the bonnet on the vehicle. The air-bag 10 then inflates in the manner as described above with reference to Figures 1 to 3 pushing the rear part of the bonnet upwardly and enabling the main part of the air-bag to lie over the lower part of the windscreen and the A-Posts of the vehicle.

In the present specification "comprise" means "includes or consists of" and "comprising" means "including or consisting of".

The features disclosed in the foregoing description, or the following Claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

## CLAIMS:

1. An air-bag arrangement in a motor vehicle, having a bonnet, the rear part of the bonnet having retaining means which engage co-operating components on the main part of the vehicle to retain the rear part of the bonnet in a predetermined position, the air-bag arrangement comprising an inflatable air-bag located adjacent a fixed part of the body of the vehicle and beneath the rear part of the bonnet of the vehicle, means being provided which, in response to inflation of the air-bag, release the retaining means so that, on inflation of the air-bag, part of the inflated air-bag will be located beneath and support the rear part of the bonnet.
2. An arrangement according to Claim 1 wherein the retaining means comprise hinge pins provided at the rear of the bonnet, each hinge pin being received within a bush, the bush being received within a recess in a support bracket mounted on the main part of the vehicle, the recess having an opening having a width slightly less than the diameter of the bush, the bush or the bracket being deformable so that, on inflation of the air-bag, the bush may pass through the opening to move out of the recess.
3. An arrangement according to Claim 2 wherein the bush is a deformable bush.
4. An arrangement according to Claim 2 or 3 wherein the bush is a cylindrical bush, and the recess is a substantially "C"-shaped recess.

5. An arrangement according to any one of the preceding Claims wherein the air-bag is initially located between a scuttle provided on the motor vehicle adjacent the lower part of the front windscreen, and a rearwardly directed face provided on the bonnet so that inflation of the air-bag will cause part of the bonnet to move forwardly to release the retaining means.
6. An arrangement according to Claim 1 wherein the retaining means comprise bonnet catches provided on the bonnet, and co-operating components on the main part of the vehicle, the bonnet catches being adapted to be released in response to inflation of the air-bag.
7. An arrangement according to Claim 6 wherein the bonnet catches are actuated by a wire or cable, the wire or cable passing adjacent part of the air-bag in the uninflated state so that, on inflation of the air-bag, tension will be applied to the wire or cable to release the catches.
8. An arrangement according to Claim 6 or 7 wherein the bonnet is a front-hinged bonnet.
9. An air-bag arrangement according to any one of the preceding Claims wherein the air-bag, when inflated, has parts thereof which extend up the "A"-Post provided at each side of the motor vehicle.
10. An air-bag arrangement according to Claim 9 wherein the air-bag, when inflated, has part thereof which extends across the lower part of the windscreens of the vehicle.
11. An air-bag arrangement substantially as herein described with reference to and as shown in Figures 1 to 3 of the accompanying drawings.

12. An air-bag arrangement substantially as herein described with reference to and as shown in Figures 1 to 3 of the accompanying drawings as modified by Figure 4.
13. Any novel feature or combination of features disclosed herein.



Application No: GB 0026932.4  
Claims searched: 1-12

Examiner: Kevin Hewitt  
Date of search: 9 February 2001

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.S): B7B (BSBA, BSBCR, BSES)

Int Cl (Ed.7): B60R 21/00, 21/34; B62D 25/10, 25/12

Other: Online WPI, EPODOC, JAPIO

**Documents considered to be relevant:**

| Category | Identity of document and relevant passage | Relevant to claims |
|----------|---|--------------------|
| X        | EP 0967128 A2 (NISSAN) See all Figs.      | 1,5,6,8-10         |
| A        | EP 0926018 A1 (CITROEN) See all Figs.     |                    |
| A        | EP 0914992 A1 (NISSAN) See all Figs.      |                    |
| X        | US 4249632 A (LUCCHINI) See all Figs.     | 1,5,6,8,10         |

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|---|---|---|--|
| X | Document indicating lack of novelty or inventive step   | A | Document indicating technological background and/or state of the art.  |
| Y | Document indicating lack of inventive step if combined with one or more other documents of same category. | P | Document published on or after the declared priority date but before the filing date of this invention.          |
| & | Member of the same patent family  | E | Patent document published on or after, but with priority date earlier than, the filing date of this application. |